

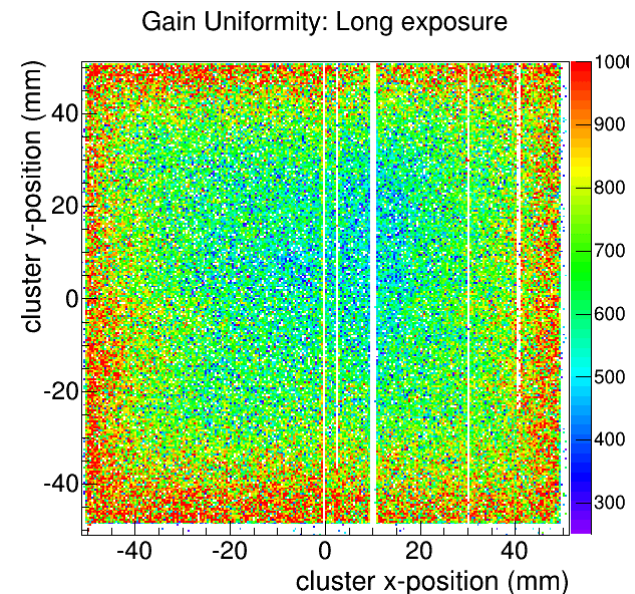
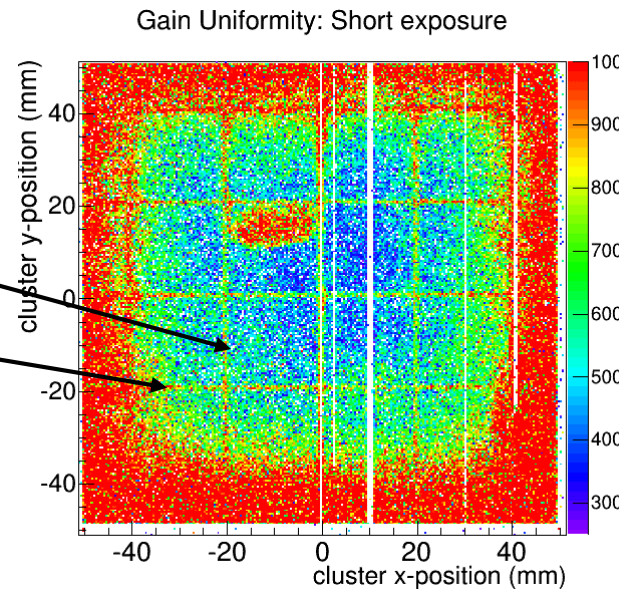
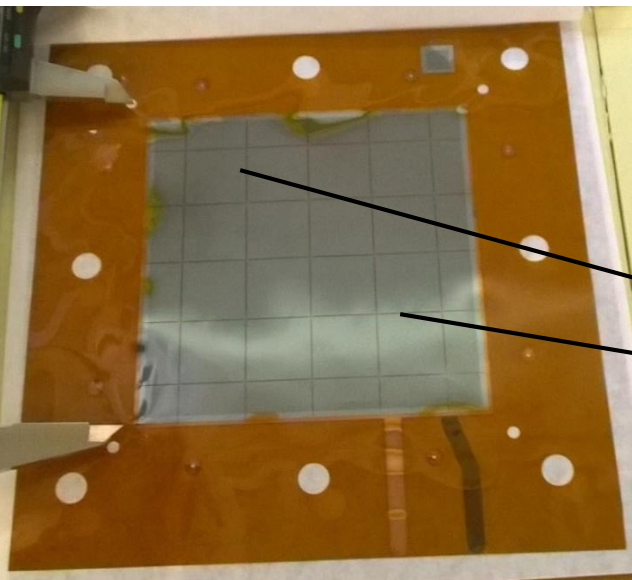
Status of the EIC R&D @ UVa

Kondo Gnanvo

EIC Weekly Meeting, Oct 30, 2017

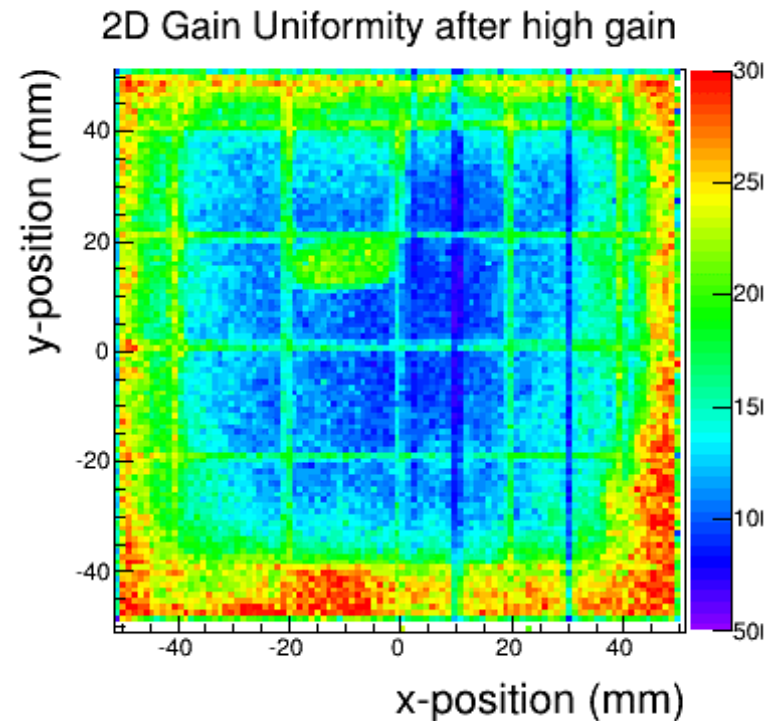
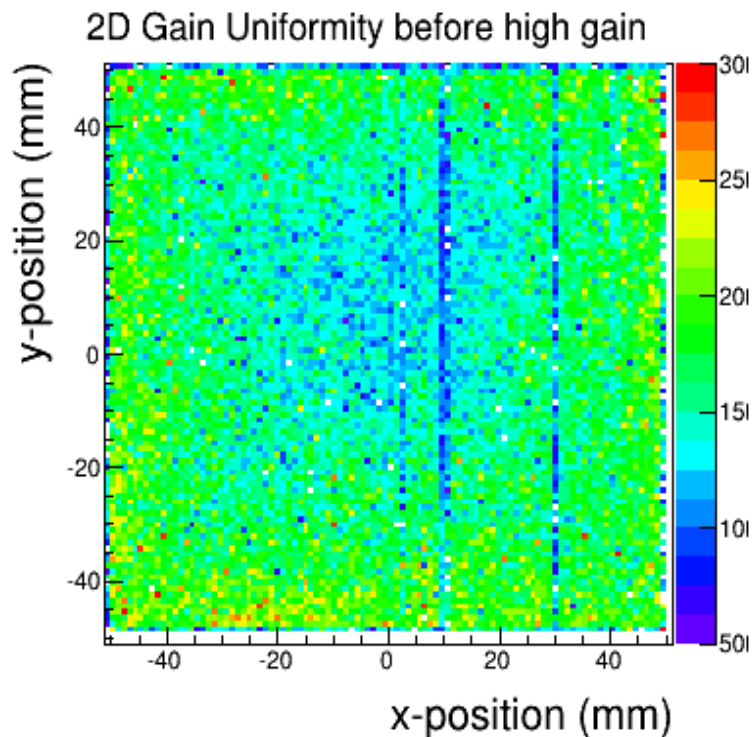
Charging up of Cr-GEM prototype

- Cr-GEM foils from CERN so far have a grid of Cu strip (pitch 2 mm, width $\sim 100\text{ }\mu\text{m}$)
- This is originally to ensure good electrical contact even when we have a local problem Cr layer
- Some charging up is observed at the beginning of each x-ray test.
- Gain is more pronounced around the grid defined by the Cu strips, This is observed at the operating HV for x-ray (equivalent ~ 1000 to 2000 for a standard triple GEM)
- After a long exposure to x-ray (more \sim day) then the gain become more uniform
 - Cu strips are not visible anymore and the relative gain variation is far less pronounced
- The phenomenon is repeatable \Rightarrow if I switch everything off for a day and restart the test, I reproduced the same effect
- Rui thinks that it might have to do with the larger holes size of the Cr after the Cu is removed
 - This is something we should be able to see with the optical scanning at Temple U or the SEM at CERN



Charging up of Cr-GEM prototype

- Similar effect was observed when working at a higher gain (~ 5000) and at higher rate
- But did not result in any permanent alteration of the Cr-GEM foils because when the test is repeated at the lower gain and lower rate, we can go back to a more uniform gain distribution
- Here again this is clearly a charging up effect caused by the Cu-Strip
- I need to repeat these tests by changing parameters one by one and also by changing only one variable at the time

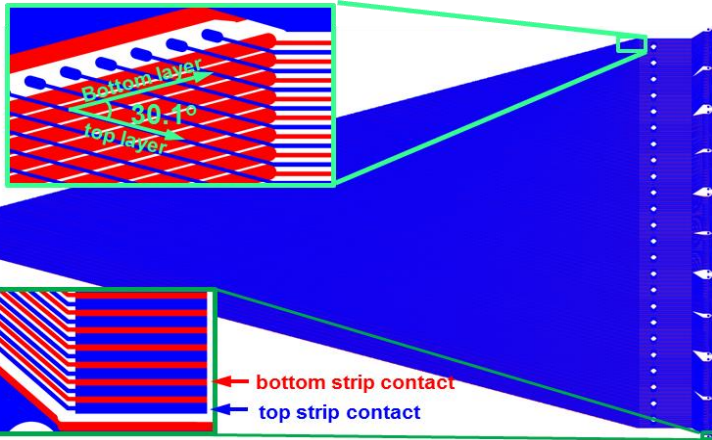


Summary and R&D plans for Cr-GEM foils

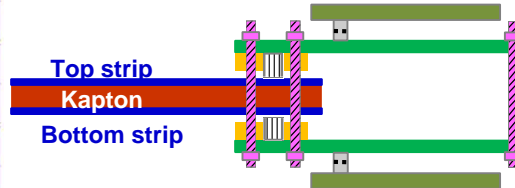
- Current Cr-GEM prototype indicate that there is no aging / radiation damage with the foils at operating gain
- It is also very stable moderate rate \Rightarrow x-ray tests were done at a rate that is probably an order of magnitude higher than what is expected for EIC in the forward region
- But charging up effect is observed at the beginning of x-ray test and also at very high gain and high particle rate
- Trip to Temple U during the week of Nov 15 to perform the optical scanning of Cr-GEMs foils (damaged foil and good foil from old batch + good foil from the newer batch)
 - Goal is to map the damage foil and try to confirm the removal of Cr-layer
 - Make hole size analysis to see whether Cr-GEM hole size can explain the charging up effect that we are observing
- Early December \Rightarrow Samples of the same foils will be shipped to CERN for the SEM measurement. **RD51 (namely Eraldo) will be helping with the logistics and administrative part of the test**
 - This should complement the optical inspection and reveal local information of the holes geometry
 - Hole size and geometry at the boundary between Cr holes and Cu-strip
- Near future \Rightarrow pursue the x-ray studies with plain Cr-GEM (with no Cu grid) and compared the Cu-grid Cr-GEMs
- **With the joint simulation studies together with Florida Tech and help from Alexander at BNL we should be able to have a full picture of the Cr-GEM for EIC**

Large FT GEM: U-V strip readout board received from CERN

Components of the zebra connection



- 2D U-V readout layer a la COMPASS, Excellent spatial resolution
- No metallized vias to pick up bottom strips signal \Rightarrow Thin Cu layer
- All FE electronics read out all on the outer radius of the chamber



Summary and R&D plans for large FT GEM prototype

- We already have had so far (last two years):
 - The GEM foils
 - The U-V strips R/O board
 - The Zebra-to-Panasonic adapter boards
- We are still waiting for and need to get ready in the next few months:
 - The support frames, we need to find ~ 6\$K if we go the our idea or splitting the production in two parts low cost local production for the outer frames (~ 1k\$) and production at RESARM Belgium of the inner frames (5\$k)
 - Order of Zebra strips already processed, waiting for delivery
 - We need to refurbish existing assembly plates ad accessories in the clean room to accommodate the EIC design
- Plan is to built the prototype built early 2018 and be ready for Test beam probably in July 2018
- We started the discussion with FTBF (e-mail exchange with Mandy Rominsky) to schedule FLYSUB test beam
 - Tentative date is July 4 to July 24 2018 (best time that we can be primary users all the time and it also more convenient for Marcus etc ...) but waiting for December confirmation from FTBF
 - So far Florida Tech and UVa are onboard (maybe eRD3 will also bring a chamber) but we would like a larger community